A Swiss apartment building for people with chemical and electrical sensitivities

Steen Hviid

Photo courtesy of Simon Zangger.

In a quiet suburb of Zurich, Switzerland, lies a four-story apartment building that is a pioneering project in design for people with chemical and electrical hypersensitivities.

Keywords: *multi-unit, apartment, flats, healthy house, MCS, EHS, chemical sensitivity, electrical sensitivity, materials, EMF, shielding, Switzerland*

The story of the project

Switzerland has a population of 8 million people and a landmass of more than 41,000 km^2. It is almost as large as the two American states Vermont and New Hampshire combined.

It is estimated that there are 5,000 people with severe multiple chemical sensitivity (MCS) in Switzerland. Some sources estimate that 30-50% of people with severe MCS also have electrical hypersensitivity (EHS).

The driving force behind the project was Christian Schifferle, who has had MCS for about 35 years. He lived for nearly twenty years in a primitive steel hut in the mountains near Zurich.

In 2008 the cooperative organization Swiss Healthy Life and Living Foundation for Multiple Chemical Sensitivity (Wohnbaugenossenschaft Gesundes Wohnen MCS) was created by Schifferle and others. The organization partnered with the City of Zurich, which donated the building lot. Once sufficient funding was available (see later), the organization held an architectural contest in 2010.

Five architect teams entered the contest, with architect Andreas Zimmermann the winner. The contest materials specified 12 apartments, but the winning design had 15. Architect Zimmermann successfully argued that the extra apartments made the project more cost-effective.

Once the contest was won, the detailed design work had to be done. This involved specialists that are not commonly part of an architectural team. “It was like attending a semester at a technical university,” Zimmermann said to a Swiss architectural magazine.

Construction started in March 2012 and ended October 2013. The project has received a lot of attention in German-language media, both radio and television, architectural magazines and even the journal for Swiss physicians.

Building site

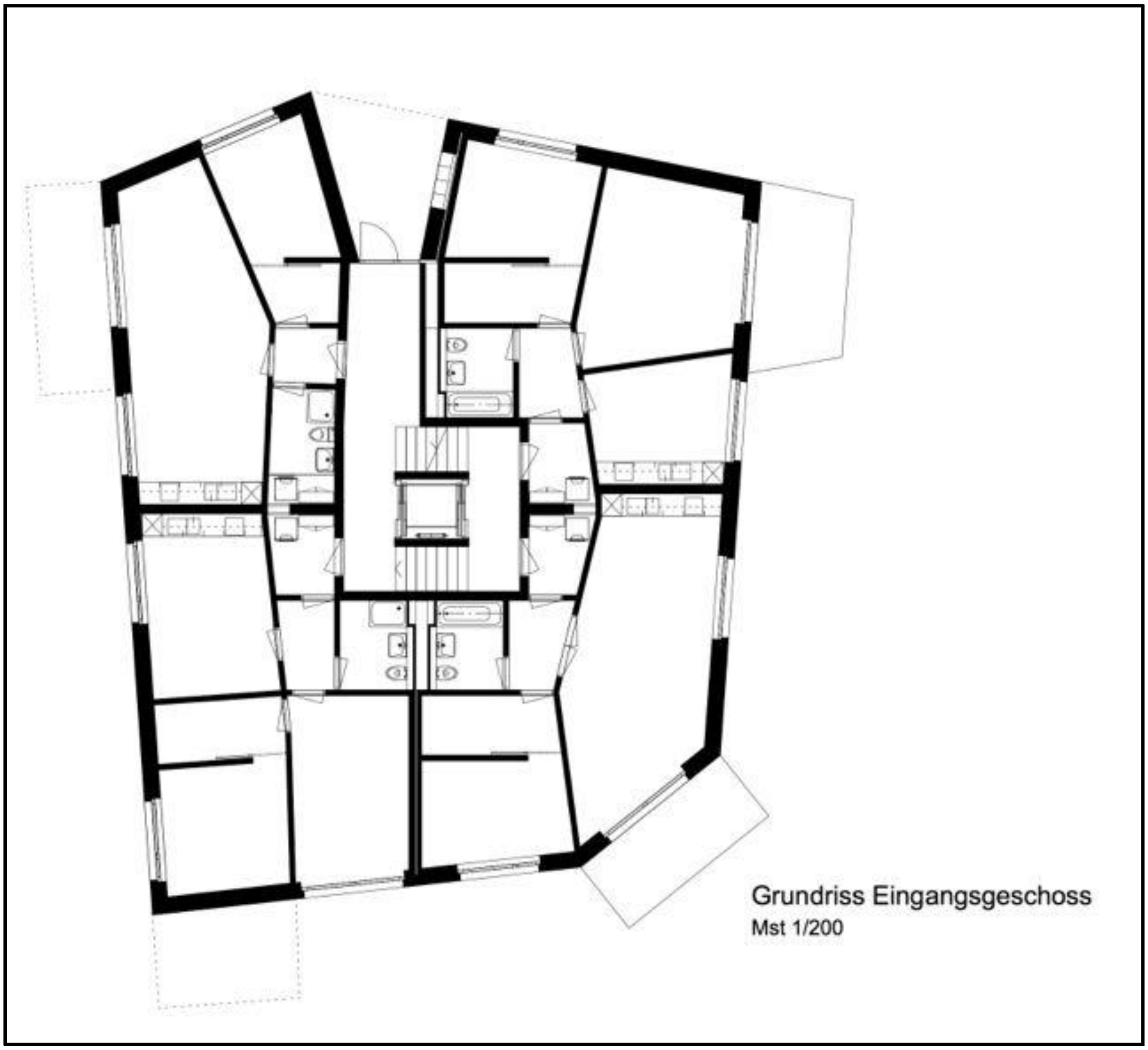
The building is located next to a forest on Mount Uetliberg in the Leimbach suburb near the city of Zurich. Zurich is the financial center of Switzerland and has a population of about a million people.

The building site was carefully chosen for low levels of radon, air pollution (NO), noise, traffic and electrosmog, which was confirmed by objective measurements. The site was also tested by a dowser.

Building design

The overall design of the building followed the many requirements to maximize the health of the renters, while the aesthetics wasn’t the main focus. The architect still wanted to make sure the building looked as normal as possible, so people living there are not constantly reminded of their illness.

The building has four stories, each with four apartments, except the top floor, which has three. The apartments have from 1 to 3 bedrooms and are from 50 m^2 (480 sq ft) to 87 m^2 (840 sq ft).



Floor plan for the ground floor with four apartments.
Courtesy of Andreas Zimmermann, architect.

The building has three concentric zones:

- central stairwell
- utility ring
- living spaces

The zones are designed so the places the occupants spend most of their time are also the most protected against air pollution and electropollution.

Model of a middle floor.

The central stairwell contains stairs and an elevator. All sorts of people may traverse this area, including visitors, maintenance people and delivery services. These people may use wireless devices and will often be scented.

The utility ring is a buffer zone between the central stairwell and the living space. It contains an airlock, hallway and bathroom for each of the apartments. The idea with the airlock is that people can arrive home with stunk-up clothes, which they can leave in the airlock before entering the rest of the apartment. People use outer garments much of the year in Switzerland, so it is important to have a place to hang them where they do not cause problems. The airlock also protects against fumes from the stairwell.

The airlock has hookups for a washing machine, so a person can simply strip off the clothes and deposit them in the washer before entering the apartment.

A suction vent in the ceiling of the airlock creates negative air pressure, so any fumes in the airlock will not enter the apartment.

The airlock has a wall-to-ceiling utility closet, through which passes the utility lines to the floors above. If maintenance is needed, the service technician will only need to enter the airlock and not the rest of the apartment. Locating the closet here also keeps the electrical wires at the maximum distance from the living area (all the wiring is also shielded).

Airlock with utility closet, entrance door and air vent in ceiling.
The washing machine has not yet been installed.

The living space is along the outer walls of the building. Some apartments have a separate kitchen, while others have the kitchen in one end of the living room. Some people need a separate kitchen, as they have trouble with cooking odors. The four kitchens on each floor are grouped two and two, to minimize EMF exposures to their neighbors.

The kitchens are located next to the utility closet in the airlock, to minimize the length of the electrical wires for the stove and refrigerator, and keep them away from the living space.

The apartments have 1, 2 or 3 bedrooms, which are located as far as possible from the kitchens and utility closets. It was planned to have a separate dressing space for each bedroom, with a sliding door in between, but that had to be omitted for budgetary reasons. Such a space is useful to store clothes, so the bedroom can be as pristine as possible.

Living room and kitchen, courtesy of Roger Frei.

Each apartment has an outdoor space, which can be used to offgas new purchases.

The building is on a sloped lot, and has a split-level floor plan. There is a basement room under one-half of the building.

Testing the materials

A large effort was expended on testing the construction materials, as people with MCS are sickened by many standard materials. It is the hope that the testing results can benefit future projects in Switzerland, including renovations of private homes to make them MCS safe.

The focus was on natural materials with a low possibility of offgassing, such as ceramics, glass and various minerals. Synthetic materials such as glue, plastic, paint and caulk were avoided as much as possible, as were wood and metals, which some people find objectionable.

The architect worked with a chemist to narrow the list of choices based on the ingredients. Then a local environmental consulting firm was contracted to test the materials using a panel of ten people with MCS.

The testers received one sample at a time, on a glass plate that had been left to offgas for a month. They were not told anything about what they were testing, to prevent any bias.

Each tester was free to test the material as they wished. They just needed to respond back on a form that had three questions:

Smell:	None	(2)
	Weak	(1)
	Strong	(0)
Reaction:	None	(2)
	Weak	(1)
	Strong	(0)
Opinion:	Not a problem (2)	
	Tolerable in small amounts (1)	
	Do not use at all (0)	

The form also had room for comments. The points were tallied for each form, and averaged. The responses were remarkably consistent.

The most thoroughly tested materials were those that covered large surfaces inside the building, such as the plaster. They tested one natural gypsum plaster, two natural clay plasters and six calcium/concrete plasters. The calcium/concrete plasters contain various additives to make them easier to work with, but which were expected to be a problem for people with MCS. Two of the manufacturers agreed to provide samples of their plaster without the additives.

The results were surprising. The natural clay and gypsum plasters were not acceptable to the testers due to their smell, while two of the regular plasters were consistently liked by the testers.

Two of the lower-rated non-natural plasters were tested a second time, with the samples offgassing for three months, but the testers didn't like them any better.

Another surprise was that the testers preferred window frames of metal and plastic rather than wood and metal.

Another thoroughly tested material was the caulk. Less important materials were tested with fewer testers.

Construction details

The outer walls are 42.5 cm (17 inches) thick. They are built with hollow-core Porotherm bricks, which are insulated with perlite. There is no additional insulation and no inner drywall. Sheets of microwave-absorbing carbon are mounted on the outside of the Porotherm bricks, with stucco on the façade. The inside walls are covered with plaster.

The interior walls, floors and roof are made of cast concrete. The concrete has no recycled aggregates and no additives (admixtures) of any kind. This type of concrete must be wet-cured and kept frost-free for several days.

The cast concrete has rebar inside. Fiberglass rebar is used in the walls and floors in the living rooms and bedrooms, as some people are sensitive to metals. The fiberglass rebar was ComBAR from Schöck in Germany. They cost much more than steel rebar, so steel rebar was used in the rest of the building.

Installing the floor tiles with thickset mortar.

The plastic tubing for the radiant floor heating system is placed on top of the raw concrete subfloor and then covered with a thickset mortar. The floor tiles are installed on the thickset mortar.

The ceilings are simply the underside of the concrete floor above, with no plastering. The pattern of the concrete forms makes it look like ceiling panels have been installed.

The roof is made from cast concrete and is flat except around the edges. The flat roof is covered with gravel while the edges are covered with metal flashing.

The elevator is a Gen2 model from Otis. It was selected because it does not need any lubricants, as it uses coated steel belts instead of conventional steel ropes. This avoids polluting the air with oil smells.

Each apartment has outlets for telephone landlines and internet, so there is no need for using any wireless communication.

Heating and ventilation

The building is heated by a ground-source heat pump, which heats water for the radiant floor heating system.

There is no cooling system for the building. The Swiss climate has mild summers, and the building is well insulated with lots of thermal mass. The Swiss building code encourages energy-efficient designs by prohibiting air conditioning in residential construction.

The building has a forced-air ventilation system. Fresh air is taken from a roof vent, filtered and then directed to each apartment. Used air is taken from the air lock in each apartment and from the stairwell, to exhaust the most polluted air directly to the outside.

Shielding

All electrical wiring in the house uses shielded cables. They are installed in a star topology, which sometimes can reduce the electromagnetic radiation.

The Swiss consulting firm Mensch und Technik Elektrobiologie measured the radiation from the indoor wiring to be

electric field:	0.1 – 0.2 V/m
magnetic field:	3 – 15 nT (0.03 – 0.15 milligauss)

The building itself is also intended to reduce radio frequency radiation from cell towers (base stations), Wi-Fi, etc. The walls are made of 42.5 cm (17 inch) hollow bricks with perlite insulation, and have a radiation absorbent carbon material mounted under the exterior stucco.

The floors, ceilings and roof are made of thick concrete.

The windows have a metallic (low-E) coating and aluminum-clad frames.

The following pulsed (peak) microwave radiation levels were measured:

outdoor: < 3.1 uW/m^2
indoor: < 0.51 uW/m^2

This means the building provides a shielding factor of 6, or less than 8 dB. This is very modest, compared with metallic shielding methods, where factors around 100 (20 dB) are common and much higher are possible.

Construction management

There was stringent oversight with the construction to make sure the contractors did not substitute any of the specified materials and to keep the use of solvents and other chemicals under control.

All workers were instructed to limit any kind of pollution. Smoking, welding and the use of disc cutters were prohibited, and the workers were asked to refrain from wearing aftershave.

Picture courtesy of Roger Frei.

Experiences with the completed building

The building was finished in October 2013. It was then offgassed for more than three weeks, before the renters were allowed to move into it.

Many visitors to the building remarked on the absence of the usual “new house smell.”

The consulting firm Büro für Umweltchemie measured the air quality and found:

Total VOC:	about 100 ug/m^3
Formaldehyde:	below 10 ug/m^3

The house was still not fully offgassed, which is quite normal, so the renters moved in cautiously over the following months. Some of them spent days in their new apartment before they also stayed the night. By the summer, all fifteen apartments were fully occupied, with each renter also sleeping there. Two years after the project was finished Schifferle says that the building works very well and that all the people there have MCS. The majority of the renters also have EHS, while some have chronic fatigue (CFS/ME). The building houses people of all ages, including children and a student. The project is a great success.

House rules

The renters are subject to strict house rules, to make sure they do not sicken their neighbors or contaminate their apartment. Several things are banned, such as tobacco, fragrances, toxic laundry products, cell phones and induction stoves.

There is a conflict mediation process, which is overseen by the City of Zurich.

Maintenance work on the building has to follow a set of guidelines to minimize the impact on the tenants.

Financing

The entire project cost 6 million Swiss francs (about 5 million euros, or US$ 6.7 million). The monthly rent is from 1180 to 2595 Swiss Francs (1000 – 2130 euros, US$ 1310 – 2900), depending on the size of the apartment. Subsidized rents are available to people with a low income.

Switzerland is an expensive country to live in, so these figures do not appear as high to the Swiss as they do to people in other countries.

The architect estimates that the use of environmentally safer materials and other special features made the building cost 20 – 25% more than a conventional building.

The use of the fiberglass rebar in some parts of the building added about 90,000 SFr (74,000 euros, $100,000) to the construction cost.

Financing came from a variety of sources, including the City of Zurich and the State, as well as donations from corporations, foundations and private individuals. The remainder of the financing was loans obtained by the co-op, which owns the building.

Some of the funding was available because it was a pilot project, which could improve future building practices in Switzerland.

Sources

The project has been covered by various media in Europe, much of which is listed on the project web site: www.gesundes-wohnen-mcs.ch.

Most of the information for this article comes from the following technical articles in the German language, which have additional pictures:

Gebaute Verträglichkeit, Katinka Corts, Swiss Architects magazine, Nov. 14, 2013.

Wohnraum für umweltkranke, TEC21, Michele Blätz Fleischli, 40/2013.

Leben in einem gesunden Wohnumfeld, Stefan Hartmann, Panorama Raiffeisen, 6/2012.

Baustofftests für MCS-Kranke, Ueli Kasser, Daniel Savi, TEC21, 10/2013.

Das Experiment, Erhard Taverna, Schweizerische Ärztezeitung, 2013; 94, 43.

The architect, Andreas Zimmermann, kindly answered additional questions and also courteously supplied the illustrations for this article, except where noted otherwise. Michael Pöll from the city of Zurich kindly provided the environmental data.

Other environmental apartment projects

Several other apartment buildings have been built or modified for people with environmental sensitivities. Some of them are detailed in articles on: www.eiwellspring.org/multiunit.html.

2014 (updated 2016)